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**Ontario  
Energy  
Board**

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IN THE MATTER OF THE  
ONTARIO ENERGY BOARD ACT  
AND IN THE MATTER OF THE  
PETROLEUM RESOURCES ACT  
AND IN THE MATTER OF A  
REFERENCE FROM THE MINISTER  
OF NATURAL RESOURCES OF APPLICATIONS

BY

**DOW CHEMICAL CANADA INC.**

PERMITS FOR BRINE  
RECOVERY OPERATIONS IN MOORE TOWNSHIP

E.B.R.M. 96

**REPORT OF THE BOARD**

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avec la Commission de l'énergie de l'Ontario.

2300, rue Yonge

26e étage

Toronto (Ontario)

M4P 1E4

Téléphone 416/481-1967

(La Commission accepte les appels  
à frais virés.)

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REPORT OF THE BOARD

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E.B.R.M. 96

IN THE MATTER OF the Ontario Energy Board Act, R.S.O. 1980, c. 332;

AND IN THE MATTER OF the Petroleum Resources Act, R.S.O. 1980, c. 377, Section 11;

AND IN THE MATTER OF a Reference to the Ontario Energy Board by the Minister of Natural Resources of applications by Dow Chemical Canada Inc. for permits to flood and maintain pressure in a geological formation where the points of injection are within 1.6 kilometres of designated gas storage areas in Moore Township, in the County of Lambton.

BEFORE:

R.M.R. Higgin  
Presiding Member

S.J. Wychowanec, Q.C.  
Chairman

REPORT OF THE BOARD

April 5, 1990

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Ontario  
Energy  
Board

Commission  
de l'Énergie  
de l'Ontario

P.O. Box 2319  
2300 Yonge Street  
26th Floor  
Toronto, Ontario  
M4P 1E4  
416/481-1967

C.P. 2319  
2300, rue Yonge  
26<sup>e</sup> étage  
Toronto (Ontario)  
M4P 1E4  
416/481-1967

April 5, 1990

The Honourable Lyn McLeod  
Minister of Natural Resources  
6th Floor, 6323 Whitney Block  
99 Wellesley Street West  
Toronto, Ontario  
M7A 1W3

Dear Minister:

On April 20, 1989, the Ontario Energy Board received a Reference under Section 11 of the Petroleum Resources Act, concerning applications by Dow Chemical Canada Inc. for permission to inject water into a geological formation for the purpose of brine recovery, where the points of injection are within 1.6 kilometres of designated gas storage areas in Moore Township.

The Board has held a hearing into the applications under Board File No. E.B.R.M. 96, and herewith submits its Report and Recommendations.

Respectfully Submitted,

R.M.R. Higgin  
Presiding Member

S.J. Wychowanec, Q.C.  
Chairman

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**1. THE APPLICATIONS AND REFERENCE**

- 1.1 Dow Chemical Canada Inc. (Dow or the Applicant) on November 8, 1988, applied to the Minister of Natural Resources (the Minister) under Section 10 of the Petroleum Resources Act for nine permits to drill wells and, under Section 11 of that Act, for permission to inject water into these wells to recover salt from lands located on Lots 23 and 24 Concession XI in the Township of Moore (the Applications).
- 1.2 The location of the wells and proposed salt recovery operations are within 1.6 kilometres of three designated gas storage areas, namely the Dow-Moore, the Corunna and the Seckerton Pools, which are operated by Tecumseh Gas Storage Limited (Tecumseh), a gas storage company owned jointly by The Consumers' Gas Company Ltd. and Imperial Oil Limited.
- 1.3 Since the proposed points of injection are within 1.6 kilometres of the designated gas storage areas, the Minister, on April 20, 1989, referred

the Applications to the Ontario Energy Board (the Board).

1.4 The Board, upon receiving such a reference, is required under Section 11(4) of the Petroleum Resources Act to hold a hearing and report to the Minister:

- (a) if the point of injection is within 1.6 kilometres of a designated gas storage area; or
- (b) if, in the opinion of the Board, the circumstances of the case so require.

1.5 Ontario Regulation 666/85 made under the Petroleum Resources Act states that:

No person shall complete or service, or otherwise perform work of any kind on, a well within 1.6 kilometres of a gas storage area designated by order of the Ontario Energy Board pursuant to the Ontario Energy Board Act if the completion, servicing or other work will or is likely to fracture, or create communication with, the gas reef situated within the designated gas storage area.

1.6 In a hearing under Section 11(4) of the Petroleum Resources Act and in its report, the Board's primary concern is protection of the designated gas storage area(s) from damage arising from the proposed operations. However, the Board also

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considers land and environmental impact, landowner concerns and future use of the brine caverns.

- 1.7        The Board, if it recommends approval, may also recommend such conditions as it deems appropriate to protect the gas storage area(s) and the natural environment.



**2. THE HEARING**

2.1 The Board issued its Notice of Application on June 20, 1989, which also set out the procedure for applying for intervenor funding under the Intervenor Funding Project Act, 1988. Procedural Order No. 1, dated January 9, 1990, gave directions for filing of inter-rogoratories and responses thereto and the prefiling of evidence by intervenors and Board Staff.

2.2 No applications for intervenor funding were received and the Board issued its Notice of Hearing on February 22, 1990, setting March 8, 1990 as the date for the hearing.

**Appearances**

2.3 The following parties were represented in the hearing:

Dow L. Ricchetti

Board Staff R.R. Elliott, Q.C.

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**Witnesses**

2.4           The Applicant called the following witnesses:

|              |                                                       |
|--------------|-------------------------------------------------------|
| D.R. Buchser | Area Superintendent<br>of Wells, Dow                  |
| V.E. Hill    | President,<br>Victor E. Hill<br>Geological Consulting |

**Notice and Service**

2.5           Counsel to Board Staff informed the Board that proof of service of the Notice of Hearing on the County of Lambton and on Moore Township, who were not parties to the hearing, was unclear from the affidavit filed by the Applicant. In addition, the service of the Notice of Hearing on the two intervenors, namely Union Gas Limited and Nova Petrochemicals Inc. (formerly Polysar Inc.) was not effected until February 28, 1990.

2.6           Counsel for the Applicant confirmed that service had been effected on the County of Lambton and on Moore Township, albeit not until March 2, 1990. He also stated that he had contacted counsel for the two intervenors who indicated they had received the Notice of Hearing and would not be appearing at the hearing.

2.7           The Board found that no parties were prejudiced by the short service period and that it was in the public interest to proceed with the hearing.

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- 2.8           A copy of all exhibits and a verbatim transcript of the proceeding are available for review at the Board's offices.



**3. THE EVIDENCE AND ISSUES**

**3.1 Background**

3.1.1 Dow, a federally incorporated company, is a wholly owned subsidiary of The Dow Chemical Company, a world-wide chemical company. Dow's Sarnia operations, employing some 1,300 persons, have grown into a 20 plant complex occupying approximately 460 acres, with a total estimated capital investment of \$850 million. In addition, approximately 3,500 acres in Sarnia and Moore Townships are dedicated to mining development, including oil and gas exploration, hydrocarbon storage and brining operations. The products produced by Dow in Sarnia are sold in over 40 countries around the world.

3.1.2 One of the primary reasons for Dow's decision to locate in the Sarnia area was the presence of substantial deposits of salt in the Michigan Salt Basin underlying the Sarnia area. These salt deposits are essential to Dow's manufacturing processes, since the brine resulting from salt

solution mining is the feedstock for the production of both chlorine and caustic soda, two of Dow's basic products. The chlor-alkali manufacturing facilities comprise the largest complex on the Sarnia site and its related products represent approximately 50 percent of the Sarnia Division's total sales. Therefore, the brining location and its proximity to the manufacturing division is important to Dow's ongoing operations.

- 3.1.3 Products dependent on chlor-alkali production are vinyl chloride used in the manufacture of polyvinyl chloride (film, flooring, pipe), chlorinated hydrocarbons (cleaning), and hydrochloric acid.
- 3.1.4 Dow stated that in order to satisfy present and projected production requirements, it must have a long term assured supply of brine from its Sarnia brine fields. At present, Dow's salt requirements are approximately 900,000 tonnes per year.
- 3.1.5 Dow has purchased over 2,800 acres (1,133 hectares) in Moore Township for the purpose of solution mining the salt beds located underground. The replacement cost of this land is in excess of 8 million dollars.

3.1.6 Dow commenced its brining operations in Moore Township in 1957 and since then it has drilled and mined 79 brine wells, of which 38 are active. In addition, numerous pipelines totalling 48 km in length, have been constructed and laid between the brine sites and the production plants to ensure the flow of the brine feedstock.

3.1.7 Dow's brining operations in Moore Township involve drilling through the B Salt and into the Silurian A2 salt formation at an approximate depth of 1,700 feet below sea level. Water is pumped to the site from the St. Clair River, injected into the well and then removed as brine.

**Need for Proposed Wells**

3.1.8 Dow stated that given the considerable amount of leadtime required to drill wells and to bring them into production, it is necessary to start the development of additional brine wells as soon as possible to avoid interruptions to its production.

3.2 **Gas Storage Areas and Proposed Well Locations**

3.2.1 Designated gas storage areas in Southwestern Ontario are naturally formed, gas-bearing pinnacle reefs which are located at depths of approximately 1,700 to 2,200 feet below sea level.

- 3.2.2 A gas-bearing pinnacle reef, once produced and depleted, may be used for the storage of natural gas. For a gas-bearing pinnacle reef to be put into storage use, the area must be designated as a gas storage area by a regulation made under the Ontario Energy Board Act, (the Act).

**Proposed Well Sites**

- 3.2.3 As noted earlier, there are three designated gas storage areas in the vicinity of the proposed wells - the Dow-Moore, Corunna and Seckerton gas storage areas. The designated gas storage pools and the 1.6 kilometres (approximately 1.0 mile) perimeter around the designated gas storage areas are shown in Figure 1, which also shows the location of Dow's present brine fields and the nine proposed brine well sites designated as numbers 86, 87, 88, 89, 90, 91, 92, 93 and 94.

- 3.2.4 All of the proposed wells are within 1.6 kilometres of the designated boundary of one or more of the storage pools. The nearest well to the Seckerton and Corunna Storage areas is well number 89 which is located approximately 1,100 metres from the designated boundary of the Seckerton Pool. The nearest well to the Dow-Moore Pool is well number 86, which is approximately 427 metres from the designated pool boundary.

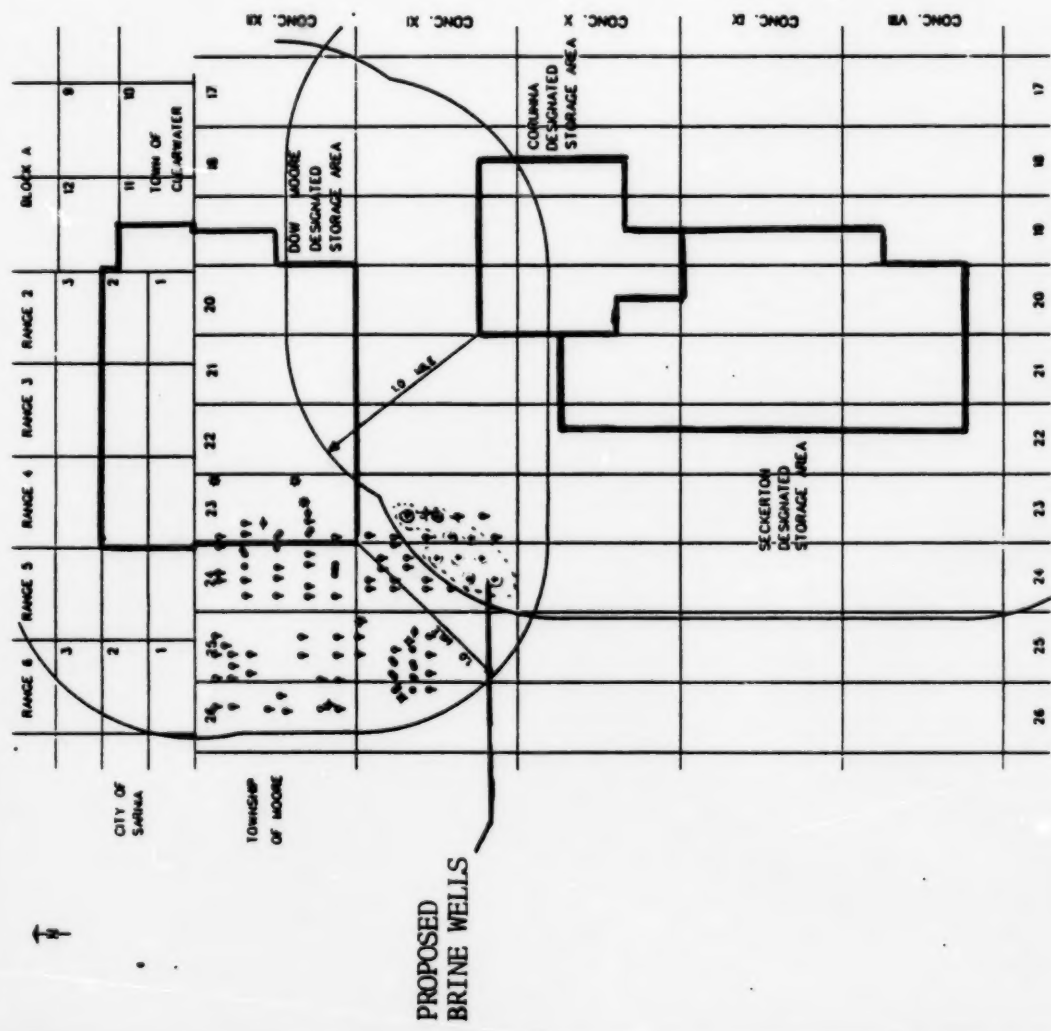
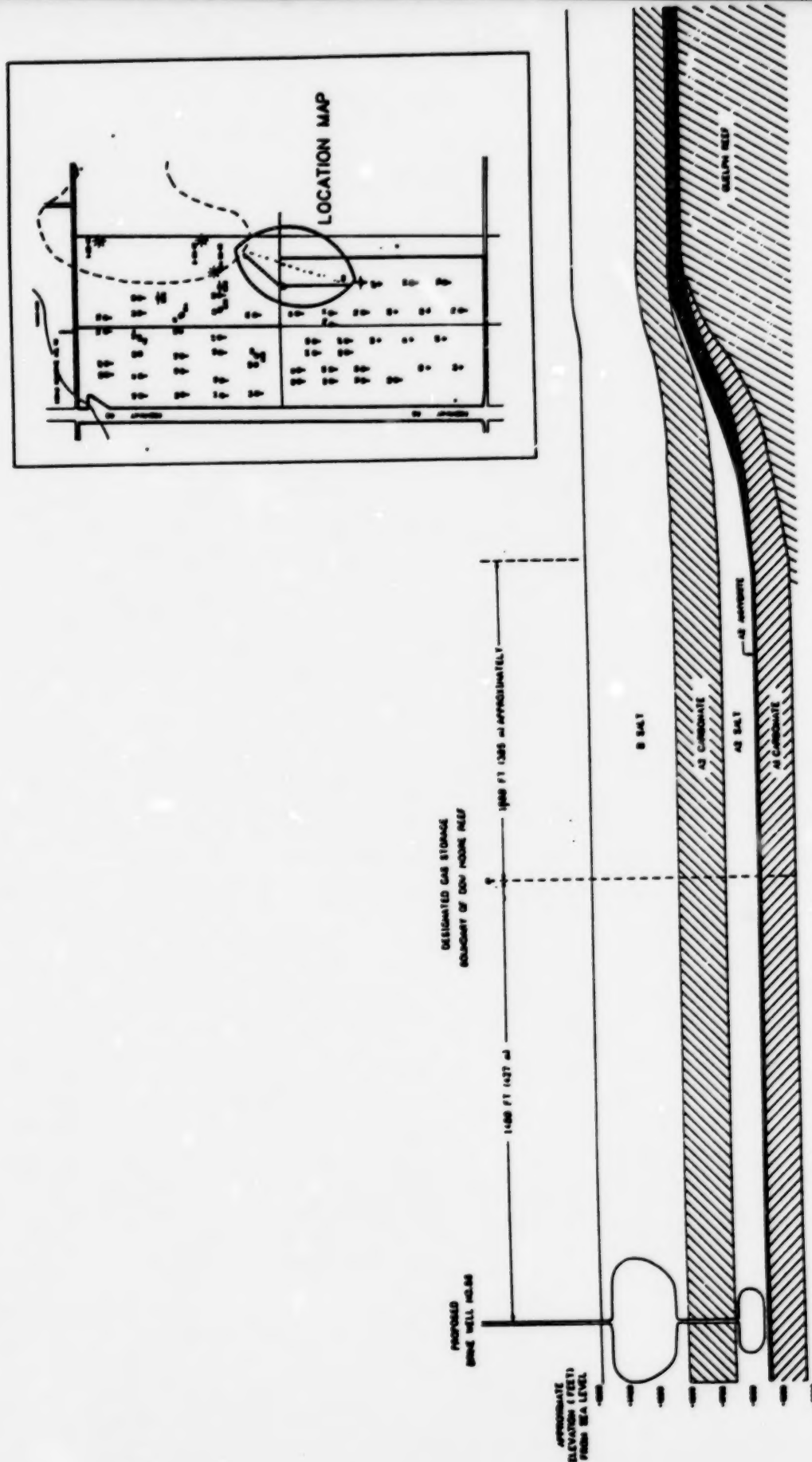


FIGURE 1 BRINE WELLS AND DESIGNATED GAS STORAGE AREAS

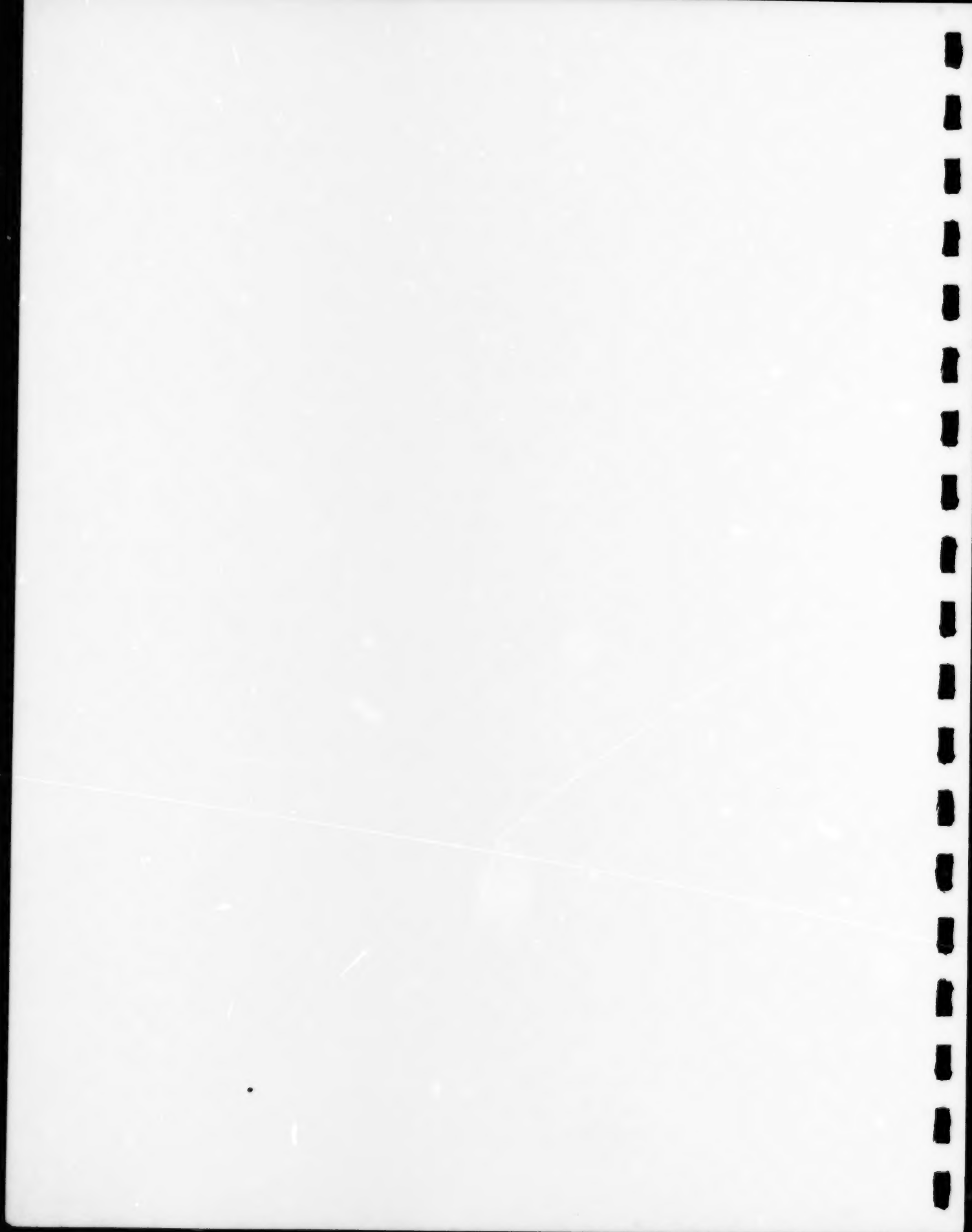
3.3        **Proposed Brine Well Operations**

- 3.3.1        Dow stated that of the nine wells applied for, it intends to immediately mine and operate the three wells numbered 89, 91 and 92. Dow stated that it intends, within the next five years, to mine and operate the remaining wells numbered 86, 87, 88, 90, 93 and 94. However, in order to facilitate matters for all parties involved, its evidence dealt with all nine proposed wells.
- 3.3.2        Dow provided details of its proposed well drilling and cavern development program, a diagram of a typical well completion and a cross-section of a typical brine cavern. This is shown in Figure 2 which illustrates well number 86 situated 427 metres from the boundary of the Dow-Moore Pool.
- 3.3.3        Dow stated that all of the proposed brine operations would be of the single well type and there would be no hydrofracturing between pairs of adjacent wells. This drilling, completion and cavern development program is identical to that which was reviewed and approved by the Board in E.B.R.M. 70 and 74.
- 3.3.4        Dow stated that the brine operations would be carried out at low pressure and that, during the drilling of a well, the pipe at surface is open to the reserve pits, thereby precluding the



SCHEMATIC CROSS-SECTION OF BRINE WELL AND PINNACLE REEF

**FIGURE 2**



application of additional pressure to the formation other than that due to friction loss and fluid column pressure.

- 3.3.5 Dow's evidence was that the brining program would result in a maximum operating pressure gradient of 0.65 psi per foot. This pressure gradient is substantially less than that required to fracture the geological formation.

**Geological data on the Area and Proposed Brine Caverns**

- 3.3.6 Dow presented evidence from a consulting geologist who had been retained to confirm the validity of the proposed brining operations. The geologist stated that available well data confirmed the uniform geology of the area. He also testified that, based on the geological cross-sections and available seismic data in the Moore Township Block, there is no evidence that parts of the Seckerton, Corunna or the Dow-Moore Reef or any reef extensions occur in the vicinity of the proposed wells numbered 86-94.

- 3.3.7 Dow's consulting geologist also stated that, again based on well log and seismic data, there was no evidence of porous Al Carbonate extensions of the storage reefs beyond the boundary of the designated gas storage areas. For these to be present there would have to be evidence of faulting, and there was no such evidence. He

found that there was adequate lateral separation between the proposed brine caverns and the nearest designated gas storage area.

3.3.8 Further geological evidence was presented that the proposed brine caverns would be vertically separated from the formation containing the gas storage reef. As shown in Figure 2, the major recovery operations are in the A2 and B salt zones respectively. The geology of the area is such that the relatively impervious A2 Anhydrite lies between the A2 salt and the A1 carbonate, thus providing a physical separation and barrier to interaction between the two formations.

3.3.9 Board Staff raised the possibility of roof collapse in the brine caverns and the effect that this could have on surrounding rock formations. Dow's evidence was that, other than for rock lenses contained in the salt formation which may be released during brining, the possibility of roof collapse was remote. This had not occurred in other caverns in the area and the risk of collapse was also no different whether the top of the cavern was of convex or concave shape.

3.3.10 Dow's geological consultant summarized the two important geological factors determining whether the proposed caverns could be operated without impact on the gas storage pools in the area:

- (a) the actual spatial separation between the proposed caverns and the reefs in the area is substantial and, given the known uniform geology, there was no geological evidence that there would be any interaction between the brining operations and the gas storage operations; and
- (b) the proposed caverns in the B and A2 salt zones are also physically separated from the reefs by geological strata (namely the A2 Carbonate and the A2 Anhydrite) which would inhibit, if not prevent, their interaction even if the spatial separation of the activities was much less.

3.3.11 In the opinion of Dow's consultant, the spatial separation of the proposed caverns and the gas reefs, as well as the known uniform geology, results in substantial geological protection of the gas reefs from the effects of Dow's proposed drilling and mining program.

#### **Future use of Salt Caverns**

3.3.12 Completed salt caverns are suitable for storage of liquid petroleum gases (LPG) such as ethylene, propane and butane. Dow is using some of its completed salt caverns for this purpose and Nova Petrochemicals Inc, (formerly Polysar Inc.) also uses salt caverns for this purpose. Dow stated that, although the caverns developed in

conjunction with the nine wells are suitable for LPG or product storage, because of the present business forecast, these caverns are not scheduled for any other purpose. Therefore they would be abandoned after completion of salt recovery, in accordance with proper procedures as approved by the Ministry of Natural Resources.

3.4        **Applicant's Prior Experience in Designated Gas Storage Areas**

3.4.1       Dow summarized its previous experience in drilling and operating brine wells within 1.6 kilometres of a gas-bearing pinnacle reef, specifically in proximity to the Dow-Moore reef. Although the Dow-Moore reef was not a designated gas storage area at the time of drilling and mining of these wells, it has since been so designated pursuant to the provisions of the Act and Ontario Regulation 700 thereto.

3.4.2       Dow stated that it has safely and successfully conducted numerous brine well drilling and solution mining operations within 1.6 kilometres of the designated gas storage boundary around the Dow-Moore reef, with no observed problems or detrimental effects on the reef.

3.4.3       In addition to its experience near the Dow-Moore reef, Dow stated that it also has experience in drilling and operating brine wells within 1.6 kilometres of the Corunna and Seckerton reefs.

Dow wells numbered 73, 77, 78 and 79 are all within 1.6 kilometres of these reefs. An application for these wells was made in 1983. The application resulted in a hearing under Board File Nos. E.B.R.M. 70 and 74. The Board, in its Report, recommended that Dow be permitted to drill and operate these brine wells.

3.4.4 Dow stated that during the drilling and the past two years of operations of these wells, no communication has been observed between the reefs and its wells. In addition, the geological information obtained from the drilling of wells numbered 73, 77, 78 and 79 confirmed that the geology of the area is uniform and consistent.

3.4.5 Dow stated that in 1986 Tecumseh had reviewed the geological information available with respect to the Dow-Moore Pool. Tecumseh concurred that Dow could continue to operate all of its existing wells and could drill additional single wells in the A2 and B salt layers outside of a zone situated 1,000 feet from the Dow-Moore designated gas storage area, without any impact on the Dow-Moore reef. Dow's solution mining activities in the vicinity of the Dow-Moore reef were also thoroughly examined at the hearing of Tecumseh's application for the designation of the Dow-Moore reef (E.B.O. 147). At the conclusion of E.B.O. 147, the Board was satisfied that Dow's existing operations, (which were substantially closer than .

the presently proposed wells) would not have a negative impact on the Dow-Moore Pool.

- 3.4.6 Tecumseh provided a letter, which was filed in evidence in this proceeding, confirming that it has received notice of the applications for the nine wells and advising that it supports Dow's applications, subject to the Board imposing appropriate conditions of approval.

**Landowner Concerns**

- 3.4.7 Since Dow owns all the lands overlying the proposed brine operations there are no other landowner concerns to be addressed by the Board.

3.5 **Environmental Concerns**

- 3.5.1 The principal environmental concerns raised by Board Staff were protection of the potable water aquifer and avoidance of groundwater contamination due to brine spills or storm water run-off.
- 3.5.2 Dow stated that its well drilling and completion program would ensure no contamination of the aquifer by drilling fluids or salt solution. At the aquifer level, water only would be used for drilling and casing would be cemented past the aquifer level before drilling resumed.

- 3.5.3       Dow stated that during operations of brine wells, periodic inspection of the well head assembly and casing was undertaken. In addition, the flow of fluids was monitored so that any leakage from the well would be detected and remedial action taken quickly.
- 3.5.4       With regard to brine spills, Dow stated that during routine solution mining, the wells are operated so that the brine flows through open-ended pipe into a gathering pond. Consequently, no appreciable back pressure is experienced at the well head. The pond level is monitored by ultrasonic level indication producing a continuous signal in the plant control room. A built-in alarm system warns of high and low pond levels. The brine system also operates on a mass balance with flows to and from the wells traced by a computer.
- 3.5.5       Dow also stated that it had recently installed a new storm water catchment and containment system around its brine field and that, in addition to monitoring and controlling brine pond levels, it monitors for chloride excursions in the storm water collection system at the discharge point. Any brine leakage or spillage would be detected and the collection system isolated to impound the water until the problem was rectified. Dow characterized the ponds and catchment system as a double containment system which is monitored to

prevent any discharge of saline waters into the natural environment.

3.6        Conditions of Approval

3.6.1        Dow indicated that it had reviewed a proposed set of conditions of approval suggested by Board Staff and, with one exception, was agreeable to these becoming part of the Board's Report to the Minister.

3.6.2        Dow stated that a proposed condition, related to hydrostatic testing of the brine caverns upon completion of the recovery operations, was an unnecessary condition which would result in considerable inconvenience and expense for no benefit. Dow contended that the proposed condition of approval requiring a sonar log of the completed cavern, together with abandonment in accordance with approved standards, was adequate protection. It further pointed out that any loss of integrity of the cavern would result in inflow to the cavern due to the differential pressure gradient being from the surrounding formation to the cavern under the conditions proposed for the brine operations.

3.6.3        Based on this evidence, Board Staff agreed to withdraw their proposed condition of approval requiring recommendations for hydrostatic testing of the caverns prior to abandonment.

3.7        Positions of the Parties

- 3.7.1        Dow stated that it is aware of the importance of the designated gas storage reefs in the area as natural gas storage for the distribution of natural gas to consumers and that it has no intention of adversely affecting these reefs.
- 3.7.2        Dow submitted that on the basis of a careful and comprehensive review of its own drilling and brining procedures developed over many years of experience in the Sarnia area, and the detailed geological information available, it is completely satisfied that the drilling and production methods it proposes would be carried out with no adverse impact on the designated gas storage reefs.
- 3.7.3        Dow recommended against imposing any specific requirement for environmental approvals and certificates, but indicated it was willing for the Ministry of the Environment to review its proposed operations to determine if any additional permits, other than those already held by the Company, were necessary.
- 3.7.4        Board Staff supported Dow's Applications for the nine injection permits, subject to the proposed conditions of approval, as amended, being attached to the injection permits.

- 3.7.5 Board Staff also recommended that the Ministry of the Environment be requested to consider whether certificate of approval was required for the brine operations under Section 8 of the Environmental Protection Act.
- 3.7.6 Dow, in reply, argued against the Board stipulating any specific requirement for a certificate of approval and reiterated its position that the Ministry of the Environment should make a determination if any further permits or approvals are required when it reviews the company's information on the proposed brine recovery operations.

**4. BOARD FINDINGS AND RECOMMENDATIONS**

**4.1 Board Findings**

**Integrity of the Gas Storage Areas**

4.1.1 The Board finds that the proposed injection wells and brine recovery operations pose no foreseeable risk to the integrity of the Dow-Moore, Seckerton and Corunna designated gas storage areas, provided the conditions of approval set out in Appendix A are implemented.

4.1.2 This finding is based on the following uncontested evidence:

- a) The uniform geology in the area and lack of Al carbonate extensions to the storage reefs, as confirmed by Dow's consulting geologist using geological data from both Dow's existing salt operations and from well data associated with the storage pools.

- b) The horizontal spatial separation of the wells and brine caverns from the designated storage areas. The minimum well separation is 427 metres to the boundary of the Dow-Moore gas storage area, which boundary also is established as a buffer from the reef formation used by Tecumseh for gas storage.
- c) Dow's plans to control cavern size to approximately 400 feet in diameter, thereby maintaining substantial horizontal separation to the boundary of the designated storage area.
- d) The vertical spatial separation of the B and A2 salt from the A1 carbonate formation containing the reef structure. This separation is complemented by the relatively impermeable A2 carbonate layer which lies between the A2 salt and the A1 Carbonate.
- e) The proposed salt recovery will not involve hydrofracturing in either the B or A2 salt formations.
- f) Dow's previous experience in salt recovery operations in the vicinity of gas-bearing reef formations.

**Impact on the Natural Environment**

4.1.3        The Board is of the opinion that, in reviewing any application of the type that is the subject of the current hearing, it should consider the impact of the proposed wells and salt recovery operations on the natural environment. From the evidence in this hearing, the Board is of the view that the three principal risks to the natural environment from the proposed operations are:

- a)    Contamination of the water aquifer, either during well drilling, or during subsequent well operations;
- b)    Accidental brine spills causing contamination of groundwater e.g. from the brine storage ponds; and
- c)    Contamination of storm water run-off during periods of high rainfall or the spring melt.

4.1.4        The Board finds that Dow's design of its brine caverns, salt ponds and stormwater catchment system appears to deal adequately with most foreseeable circumstances which could lead to saline contamination of the aquifer, or of groundwater or storm water run-off.

- 4.1.5        The Board also notes Dow's evidence that it combines a series of automatic monitoring points, including salt pond level and saline detection probes, to alert plant operations to any unusual occurrences, with on-site management to ensure proper operation of the process. There are therefore no obvious, undue risks to the natural environment which the Board can ascertain from the evidence in the hearing.
- 4.1.6        The Board recognizes, however, that the statutes under which it operates do not specifically encompass protection of the natural environment, nor does it have the technical expertise to judge the adequacy of Dow's monitoring and environmental protection procedures. Therefore the Board recommends that the Petroleum Resources Section of the Ministry of Natural Resources provide the Ministry of the Environment with information on proposed brine operations so that the latter Ministry can determine if any permits are required and, if so, examine the proposed operations relative to the requirements for such permits.
- 4.1.7        The Board is also of the view that, in future, applications under the Petroleum Resources Act which may require review by the Ministry of the Environment, particularly those involving oil, liquid hydrocarbons and brine, should be copied to the Director of Approvals of the Ministry of the Environment for comment.

- 4.1.8        The Board, as a matter of course, will ensure that all such future applications falling within its jurisdiction are forwarded to the Ministry of the Environment for review and comment.

**Conditions of Approval**

- 4.1.9        The Board has examined the proposed conditions of approval submitted by Board Staff, as amended during the hearing, and agreed to by Counsel to Dow and the Company's witness.
- 4.1.10       The Board has also reviewed the conditions of approval that were recommended in E.B.R.M. 70 and 74 and in the opinion finds that the proposed conditions of approval should ensure protection of the integrity of the designated gas storage areas and of the natural environment, at least to the degree the Board can judge these latter requirements. Accordingly, the Board will recommend that these Conditions of Approval as set out in Appendix A, form part of the Minister's formal granting of permission to inject.
- 4.1.11       The Board notes that Condition 6 of the Recommended Conditions of Approval set out in Appendix A, effectively imposes a two-year expiry date on the injection permit for wells. Hence, any wells not completed by that time would require a further application to the Minister under Section 11 of the Petroleum Resources Act.

- 4.1.12 The Board sees merit in the Petroleum Resources Section of the Ministry of Natural Resources reviewing Dow's proposed well completion procedure, which is set out in Schedule 7 of its prefiled evidence and, if deemed appropriate, attaching Schedule 7 to the drilling permits to be issued pursuant to Section 10 of the Petroleum Resources Act.

4.2 Recommendations

- 4.2.1 The Board recommends that, pursuant to Section 11 of the Petroleum Resources Act, the Minister of Natural Resources grant injection permits to Dow Chemical Canada Inc. for the purpose of injecting water into a geological formation where the points of injection are within 1.6 kilometres of the Dow-Moore, Seckerton and Corunna designated gas storage areas. These points of injection are:

Dow 86, Moore 23-XI;  
Dow 87, Moore 23-XI;  
Dow 88, Moore 23-XI;  
Dow 89, Moore 23-XI;  
Dow 90, Moore 24-XI;  
Dow 91, Moore 24-XI;  
Dow 92, Moore 24-XI;  
Dow 93, Moore 24-XI; and  
Dow 94, Moore 24-XI.

- 4.2.2        This permission should be granted, subject to Dow complying with the Conditions of Approval set out in Appendix A to this Report.
- 4.2.3        The Board also recommends that the Petroleum Resources Section of the Ministry of Natural Resources review Dow's proposed well completion, operation and abandonment procedures as set out in Schedule 7 of its evidence in this proceeding. If deemed appropriate by the Petroleum Resources Section to ensure protection of the natural environment these requirements could be attached to the drilling permits to be issued pursuant to Section 10 of the Petroleum Resources Act.
- 4.2.4        The Board recommends that the Petroleum Resources Section of the Ministry of Natural Resources provide information on Dow's proposed brine operations to the Approvals Section of the Ministry of the Environment for review and comment with respect to any requirements for permits under the Acts or Regulations administered by the Ministry of the Environment.
- 4.2.5        The Board also recommends that future applications for injection permits involving oil, liquid hydrocarbons or brine be reviewed by the Ministry of the Environment with respect to requirements for protection of the natural environment.

**5. COSTS AND COMPLETION OF THE PROCEEDINGS**

**5.1 COSTS**

5.1.1 No intervenors requested an award of costs in these proceedings.

5.1.2 The Board's costs will be paid by the Applicant upon receipt of the Board's Cost Order and invoice.

**5.2 Completion of the Proceedings**

5.2.1 The Board herewith submits its Report and Recommendations to the Minister of Natural Resources, in accordance with the Letter of Reference dated April 20, 1989.

## Appendix A

### Dow Chemical Canada Inc. E.B.R.M. 96

#### Board Recommended Conditions of Approval

1. The salt caverns shall be designed and developed as set out in the Applications and evidence in these proceedings.
2. The salt caverns shall be located in the B salt and A2 salt formations only and there shall be a minimum clearance of 300 ft. between adjacent caverns.
3.
  - a) The operating pressure of the caverns under normal circumstances shall be such that the pressure gradient will not exceed 0.65 psi per foot depth.
  - b) There shall be relief valves and instrumentation on the process system to provide protection against abnormal operating conditions.
  - c) There shall be no fracturing of the sub-surface formations.

4. The maximum ultimate cavern diameter shall not exceed 400 feet.
5. The wells shall be hydrostatically tested to a maximum bottom hole pressure equivalent to a pressure gradient of 0.8 psi per foot depth, to ensure the integrity of the casing and cement prior to the commencement of the brining operations.
6. Issuance of any drilling permit in respect of which authorization to inject is sought, is limited to 12 months from the date of this report. The life of any such drilling permit shall not exceed a further 12 months.
7. The injection permits are limited to brine solution mining only. Any other use of the wells and caverns shall be referred to the Petroleum Resources Section, Ministry of Natural Resources, for approval.
8. Dow Chemical Canada Inc. shall undertake to ensure the fulfilment of these conditions.